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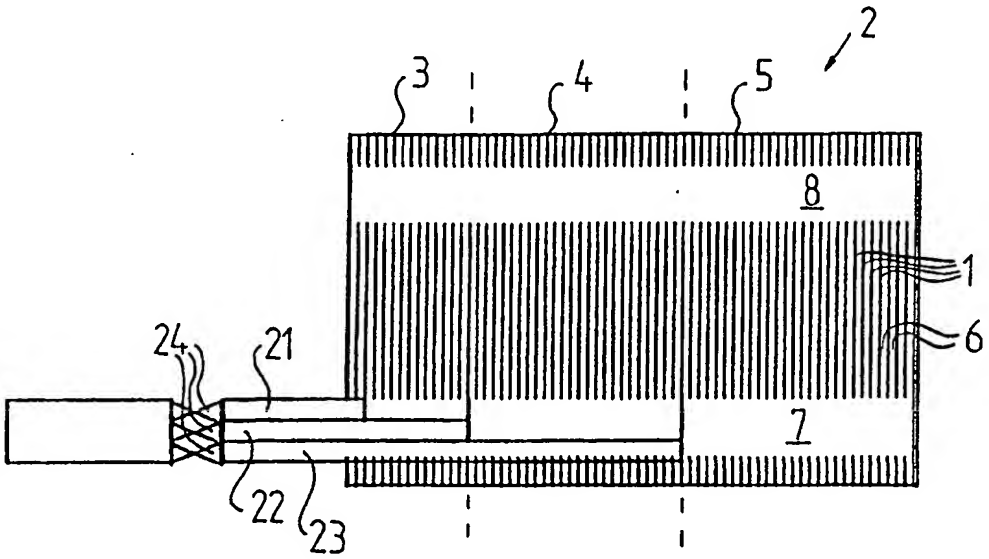

(57) Abstract

A plate heat exchanger includes a number of heat transfer plates (1), which are provided adjacent to each other in such a way that they form a plate package (2) with two channels. The channels extend in heat transferring contact to each other and are arranged to convey a respective medium through the plate package. The plate package (2) includes at least two separate sections (3, 4, 5) for at least a first of said channels. Each of the sections includes a number of said plates (1), wherein this number is different for at least two of said sections. The plate heat exchanger includes also control members (24), which permit guiding of the medium in at least the first channel in such a way that it flows through either one or several arbitrary sections of said sections (3, 4, 5).

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A plate heat exchanger

THE BACKGROUND OF THE INVENTION AND PRIOR ART

The present invention refers to a plate heat exchanger including a number of heat transfer plates provided adjacent to each other in such a manner that they form a plate package with at least two channels, which extend in heat transferring contact to each other and are arranged to convey a respective medium through the plate package, wherein the plate package includes at least two separate sections for at least a first one of said channels, wherein each of said sections includes a number of said plates and wherein the plate heat exchanger includes control members, which permit control of the medium in at least the first channel in such a manner that the medium flows through either one or several arbitrary sections of said sections.

In relation to the construction of plate heat exchangers, these are dimensioned to cope with the desired maximum capacity. However, during operation, the load on the plate heat exchanger varies in such a way that the plate heat exchanger operates at a lower load than it is dimensioned to, i.e. the plate heat exchanger is not utilised in an optimum manner. Furthermore, also the flow velocity decreases during such states of operation at a lower load. When the flow velocity decreases beneath a certain level, the shearing forces between the fluid and the plate heat exchanger becomes too low and the risk for clogging of the plate heat exchanger increases. This problem is significant within the food industry, for instance sugar production, wherein a sugar-containing medium is conveyed through a

plate heat exchanger on the cold side. A further problem is that high wall temperatures, caused by a too low flow, may result in calcification.

DE-C-610,228 discloses a plate heat exchanger having a number of heat transfer plates provided adjacent to each other to form a plate package. The plate package includes an inlet channel and an outlet channel for each medium, which extend through the plate package. In each of these channels, a valve slide is displaceably provided in such a way that by displacing the valve slides, the part of the plate package that is accessible to the medium in question may be varied.

JP-A-04,139,390 discloses a plate heat exchanger having a number of heat transfer plates provided adjacent to each other to form a plate package having two channels extending in heat transferring contact to each other. The plate package includes four equally large sections having a number of said plates. Furthermore, the plate heat exchanger includes control members permitting control of a cleaning medium in at least one of the channels in such a way that it flows either through an arbitrary section of said sections or several arbitrary sections of said sections.

SUMMARY OF THE INVENTION

The object of the present invention is to remedy the problems mentioned above. In particular, it is aimed at a plate heat exchanger, which is controllable in dependence of the flow, pressure drop and the temperature and especially adaptable to different loads in such a way that a sufficient flow velocity may be maintained.

This object is obtained by the plate heat exchanger initially defined, which is characterised in that a number of plates are different for at least two of said sections.

By guiding the medium in question through either an arbitrary section of said sections or several arbitrary sections of said sections and by the fact that the number of plates are different for each section it is possible to obtain a large amount of different total cross-section areas of the plate package. Consequently, a proper adaptation of the plate heat exchanger to different flows may be obtained and a substantially uniform flow velocity may be maintained for different load states. The risk of clogging of the plate heat exchanger will thereby be reduced.

According to an embodiment of the invention, at least a first of said channels extends through at least three sections, which each includes a number of said plates. By three sections with a different number of plates a sufficient number of different total cross-section areas of the channel are obtained for many applications.

According to a further embodiment of the invention, the plate heat exchanger includes a control member for each section, wherein each control member is arranged to enable opening or closing of the respective section. Advantageously, each control member is arranged to enable opening or closing of the respective section independently of the position of the remaining control members. Furthermore, the plate heat exchanger may include an inlet channel, which extends through substantially the whole plate package and for each section includes a separate inlet passage from the inlet channel to the respective section, wherein each control member is arranged to enable opening or closing of the respective inlet passage. In such a way, the plate heat exchanger may be adapted to different flows through an easy manoeuvring of said valves.

According to a further embodiment of the invention, the inlet channel includes a pipe, which extends through the

plate package and has a longitudinal gap forming said inlet passages. By such a pipe, each valve may include a valve element, which extends along said pipe and is rotatable between a first open position laterally of said gap and a second closed position covering said gap. The valve element may have a surface which is arranged to abut the pipe and which has a curvature that substantially corresponds to the radius of the pipe. The manoeuvring of the valve element may in an easy manner be obtained by the fact that each valve element is connected to a respective shaft, which is rotatably provided in said pipe, wherein at least one of said shafts is tubular and arranged to house another one of said shafts. By such concentrically provided manoeuvring shafts, an easy manoeuvring of a plurality of valve elements, which are provided successively along said pipe, is enabled.

According to a further embodiment of the invention, the inlet channel includes at least two separate inlet conduits, which extend in parallel to each other but have a different length in such a way that each inlet conduit extends to a respective section. Thereby, said control member may include a valve, which is provided on the respective inlet conduit. Such a valve may be positioned outside the plate package, which facilitates the mounting and enables the use of an arbitrary valve type.

According to a further embodiment of the invention, said control member is comprised by a valve plate, which is provided between two adjacent sections. In such a valve plate, the valve may be provided at one of the normal port holes of the plate and arranged to close or open the port. The valve may be realised as a slide valve or a rotatable disk valve. Furthermore, the inlet channel may include a by-pass conduit, which extends from one section through an adjacent section to a successive section of the plate

package. Such a by-pass conduit may advantageously be provided in the inlet channel.

Furthermore, said control member may include a valve, which is provided immediately upstream of the by-pass conduit, wherein this valve includes a first valve member, which is arranged to close or open the by-pass conduit, and a second valve member, which is arranged to close or open the inlet passage to said adjacent section. Furthermore, the plate heat exchanger may include an outlet channel, which extends through substantially the whole plate package and which for each section includes an outlet passage from the respective section to the outlet channel, wherein each control member includes a valve, which is arranged to enable opening or closing of the respective outlet passage. In such a way, access to an arbitrary or several arbitrary sections of the plate package may be created by means of the by-pass conduit.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is now to be explained more closely by means of different embodiments, which are disclosed merely as examples, and with reference to the drawings attached.

Fig 1 discloses a side view of a plate heat exchanger according to a first embodiment of the invention.

Fig 2 discloses a plan view of a valve plate of the plate heat exchanger in Fig 1.

Fig 3 discloses a side view of the valve plate in Fig 2.

Fig 4 discloses a longitudinal section through the plate heat exchanger in Fig 1 in a first operation state.

Fig 5 discloses the plate heat exchanger in Fig 4 in a second operation state.

Fig 6 discloses the plate heat exchanger in Fig 4 in a third operation state.

Fig 7 discloses the plate heat exchanger in Fig 4 in a fourth operation state.

Fig 8 discloses a longitudinal section through a plate heat exchanger according to a second embodiment of the invention in a first operation state.

Fig 9 discloses the plate heat exchanger in Fig 8 in a second operation state.

Fig 10 discloses the plate heat exchanger in Fig 8 in a third operation state.

Fig 11 discloses a longitudinal section through a plate heat exchanger according to a third embodiment of the invention.

Fig 12 discloses a longitudinal section through a part of a plate heat exchanger according to a fourth embodiment of the invention.

Fig 13 discloses a section along the line XIII-XIII in Fig 12.

Fig 14 discloses a section along the line XIV-XIV in Fig 12.

Fig 15 discloses a longitudinal section through the plate heat exchanger in Fig 12 in a first operation state.

Fig 16 discloses the plate heat exchanger in Fig 15 in a second operation state.

Fig 17 discloses the plate heat exchanger in Fig 15 in a third operation state.

Fig 18 discloses the plate heat exchanger in Fig 15 in a fourth operation state.

Fig 19 discloses the plate heat exchanger in Fig 15 in a fifth operation state.

Fig 20 discloses the plate heat exchanger in Fig 15 in a sixth operation state.

Fig 21 discloses a longitudinal section through a plate heat exchanger according to a fifth embodiment of the invention.

Fig 22 discloses the plate heat exchanger in Fig 21 in another operation state.

DETAILED DESCRIPTION OF DIFFERENT EMBODIMENTS OF THE INVENTION

Fig 1 discloses a first embodiment of a plate heat exchanger, which includes a number of heat transfer plates 1 which are provided adjacent to each other in such a way that they form one single, common plate package 2. The plate package 2 is divided into three sections 3, 4, 5, which each includes a number of said plates 1. As is further disclosed in Fig 1, the number of plates 1 of each section 3, 4, 5 is different, i.e. the first section 3 includes a smaller number of plates 1 than the second section 4, which in turn includes a smaller number of plates 1 than the third section 5.

Each heat transfer plate 1 includes four ports through which the media flowing through the plate package 2 may pass. The plates 1 are provided adjacent to each other in such a way that they form two separate channels, which extend in heat transfer contact to each other and are arranged to convey a respective medium through the plate package 2. Figs 4-7 illustrate such a channel 6, which includes an inlet channel 7 and an outlet channel 8. Between the inlet channel 7 and the outlet channel 8, the medium flows in a conventional manner through the plate interspaces formed between the plates 1. Figs 4-7 disclose merely two ports of each plate 1 but it is to be noted that the plate package 2 includes a further inlet channel and a further outlet channel, which are formed by the two other ports of each plate 1 and are arranged to permit passage of the second medium.

According to the first embodiment, the plate package 2 includes a first valve plate 10, which is provided between

the first section 3 and the second section 4, and a second valve plate 11 which is provided between the second section 4 and the third section 5. Each valve plate 10, 11 includes four valves 12, which each is arranged to close or open a respective port 13 of the valve plate 10, 11. In Figs 2 and 3, the valves 12 are designed as rotatable disk valves, which are rotatable about an axis 14 by means of a manoeuvring member 15. As appears from Figs 1-3, the axis 14 extends outwardly in such a way that the manoeuvring member 15 is located outside the plate package 2 proper.

With reference to Figs 8-10, a second embodiment is disclosed which differs from the first embodiment in that the plate package 2 merely includes a first section 3 and a second section 4, which are separated by means of a valve plate 10. Figs 8-10 illustrate the flow of a medium through the plate package 2 in dependence on the position of the valves 12. In Fig 8, the valve 12 located in the inlet channel 7 is closed, whereas the valve 12 located in the outlet channel 8 is open. The medium will thereby flow through the first section 3 and out through the outlet channel 8. No flow will exist in the second section 4. It is to be noted that the second section 4 may be filled by the medium flowing through the plate package 2, but at the valve position disclosed in Fig 8, there is no flowing in this medium but it is standing still in the second section 4. In Fig 9, the valves 12 in both the inlet channel 7 and the outlet channel 8 are open, which permits a flow through both sections 3 and 4. In Fig 10, the valve 12 in the inlet channel 7 is open, whereas the valve 12 in the outlet channel 8 is closed, which means that the medium merely is permitted to flow through the second section 4. By manoeuvring of the valves 12, it is thus possible to bring the medium to flow through either the first section 3, the second section 4 or both sections 3 and 4.

According to the first embodiment, the plate heat exchanger includes a by-pass conduit 16, which is provided in the inlet channel 7 and extends from the first section 3 through the second section 4 to the third section 5, see Figs 4-7. The by-pass conduit 16 has a cross-section area which is about half the cross-section area of the inlet channel 7. The by-pass conduit 16 thus permits the medium to flow directly from the first section 3 to the third section 5. The by-pass conduit 16 extends between the first valve plate 10 and the second valve plate 11. Upstream of the by-pass conduit 16, a first valve 17 is provided in the first valve plate 10, and downstream of the by-pass 16, a second valve 18 is provided in the second valve plate 11. The first valve 17 includes a first valve member 17' and a second valve member 17''. The first valve member 17' is arranged to open and close, respectively, the inlet to the by-pass conduit 16 and the second valve member 17'' is arranged to open and close, respectively, the passage to the second section 4 in the corresponding manner as the valve 12. In the same way, the second valve 18 includes a first valve member 18', which is arranged to open and close, respectively, the outlet from the by-pass conduit 16 and a second valve member 18'', which is arranged to open and close, respectively, the passage from the second section 4 to the third section 5. The valve members 17', 17'', 18' and 18'' may be realised in different ways, for instance as slide valves.

Figs 4-7 disclose how the medium flows through the plate package 2 in dependence on the positions of the first valve 17 and the second valve 18. The positions of the valve members 17', 17'', 18', 18'' are disclosed schematically beneath the respective plate package 2. In Fig 4, the valve member 17'' and the valve members 18' and 18'' are closed so that the whole flow will be conveyed through the first section 3. In Fig 5, the valve members 17' and 18' are open, which means that the medium is permitted to flow through the

first section 3 and the third section 5, whereas the second section 4 is closed. In Fig 6, all valve members 17', 17'', 18', 18'' are open and the medium flows through all sections 3, 4 and 5. In Fig 7, the valve members 17' and 17'' are open, whereas the valve members 18' and 18'' are closed as well as the valve 12 of the first valve plate 10 at the outlet channel 8, which means that the medium merely is permitted to flow through the second section 4.

Fig 11 discloses a third embodiment in which three separate inlet conduits 21, 22 and 23 extend into the inlet channel 7. The three inlet conduits 21, 22 and 23 have a different length, wherein the first inlet conduit 21 extends to the first section 3, the second inlet conduit 22 extends through the first section 3 to the second section 4, and the third inlet conduit 23 extends through the first section 3 and the second section 4 to the third section 5. Each inlet conduit 21, 22 and 23 includes a valve 24 by which the respective inlet conduit 21, 22 and 23 may be opened and closed, respectively. The valves 24 are manoeuvrable independently of each other. As appears from Fig 11, the inlet channel 7 is closed between the sections 3 and 4 as well as between the sections 4 and 5, i.e. the medium cannot flow from the inlet channel 7 in the first section 3 to the inlet channel 7 in the second section 4 or from the inlet channel 7 in the second section 4 to the inlet channel 7 in the third section 5. The inlet channel 7 in the different section may thus merely be reached via the respective inlet conduit 21, 22 and 23. Consequently, the flow through the plate package may by guided to the different sections 3, 4 and 5 by opening and closing, respectively, of the valves 24 of the three inlet conduits 21, 22 and 23. The supply of medium to the inlet conduits 21, 22 and 23 is performed by means of a common conduit upstream of the valves 24.

Figs 12-20 disclose a fourth embodiment, which includes a pipe 30 extending in the inlet channel 7 through the plate package 2. The pipe 30 includes a longitudinal gap 31, which extends along all the three sections 3, 4 and 5. The gap 31 forms an inlet passage from the pipe 30 to the respective section 3, 4 and 5. Three valve elements 32 are provided in the pipe 30 successively after each other in such a way that a first valve element 32 extends along the whole length of the first section 3, a second valve element 32 extends along the second section 4 and a third valve element 32 extends along the third section 5. The valve elements 32 are rotatable independently of each other between a first open position laterally of the gap 31 and a second closed position covering the gap 31. Each valve element 32 is connected to a respective shaft 33, 34 and 35. At least the shafts 34 and 35 are hollow, wherein the shaft 35 is arranged to house the shaft 34 which in turn is arranged to house the shaft 33. The shafts 33, 34 and 35 are thus concentric and rotatable independently of each other by means of a manoeuvring member 36. Figs 13 and 14 disclose more closely how the valve elements 32 are rotatable between an open position, Fig 13, and a closed position, Fig 14. As appears from Figs 13 and 14, the pipe 30 has an inner radius r, which substantially corresponds to the radius of curvature of the outer surface of the valve element 32. It is to be noted that the plate package 2 may include more than the disclosed sections 3, 4, 5, for instance a section for substantially each plate interspace. In this case, the plate heat exchanger includes a valve element 32 for each plate interspace, wherein each valve element 32 is connected to a respective concentric shaft.

Figs 15-20 disclose how the flow through the plate package 2 may be guided to the different sections 3, 4, 5 by adjustment of the valve elements 32. In Fig 15, the valve elements 32 of the first section 3 and the second section 4

are closed, which means that the medium flows through the third section 5. In Fig 16, merely the valve element 32 of the second section 4 is opened, wherein the medium flows through the second section 4, and in Fig 17 merely the valve element 32 of the first section 3 is opened, wherein the medium in a corresponding manner merely flows through the first section 3. In Fig 18, the valve elements 32 of the first section 3 and the third section 5 are opened, wherein the medium is permitted to flow through these sections. In a corresponding way, the valve elements 32 of the second section 4 and the third section 5 in Fig 19 are open and of the first section 3 and the second section 4 in Fig 20.

Figs 21 and 22 disclose a fifth embodiment, which differs from the other embodiments disclosed in that the plate heat exchanger includes two end plates 40, 41, which are provided with valves 12 of at least two ports, i.e. at least for one of the channels. In such a way, it is possible to guide and change the flow direction of the medium through the different sections 3, 4, 5.

The invention is not limited to the embodiments disclosed but may be varied and modified within the scope of the following claims.

It is to be noted that in the figures merely the way of guiding a medium through one of the two channels of the plate heat exchanger has been disclosed. It is also possible to provide a similar arrangement also for the second channel and in such a way adapt the flow also in this channel. It is also possible, within the scope of the invention, to adapt only one channel of the plate heat exchanger, for instance at the second side.

The number of sections of the plate heat exchanger may be varied and may be larger than in the disclosed embodiments

having two or three sections. The plate heat exchanger may within the scope of the invention include four, five, six or more sections. When the number of sections is large, an advantageous controllability may be obtained even if the number of plates is not unique for each section. In the most extreme case, substantially each section may include merely two plates 14, i.e. merely one plate interspace, wherein a control step having merely one plate interspace is obtained, and at the same time it is possible to select one or several arbitrary plate interspaces of the total number of plate interspaces of the heat exchanger.

The plate heat exchanger in the embodiments disclosed above includes two channels. Within the scope of the invention, the plate heat exchanger may also include three or possibly even more channels. By three channels each plate will include six ports, a selected number of which may be provided with control members according to the embodiments disclosed above.

Claims

1. A plate heat exchanger including a number of heat transfer plates (1) provided adjacent to each other in such a manner that they form a plate package (2) with at least two channels, which extend in heat transferring contact to each other and are arranged to convey a respective medium through the plate package (2), wherein the plate package includes at least two separate sections (3, 4, 5) for at least a first one of said channels, wherein each of said sections includes a number of said plates (1) and wherein the plate heat exchanger includes control members (12, 17, 18, 24, 32), which permit control of the medium in at least the first channel in such a manner that the medium flows through either one or several arbitrary sections of said sections (3, 4, 5), characterised in that the number of plates (1) is different for at least two of said sections (3, 4, 5).

2. A plate heat exchanger according to claim 1, characterised in that at least a first of said channels extends through at least three sections (3, 4, 5) which each includes a number of said plates (1).

3. A plate heat exchanger according to any one of claims 1 and 2, characterised in that the plate heat exchanger includes a control member (12, 17, 18, 24, 32) for each section (3, 4, 5), wherein each control member is arranged to enable opening or closing of the respective section (3, 4, 5).

4. A plate heat exchanger according to claim 3, characterised in that each control member (12, 17, 18, 24, 32) is arranged to enable opening or closing of the respective section (3, 4, 5) independent of the position of the remaining control members.

5. A plate heat exchanger according to any one of claims 3 and 4, characterised in that the plate heat exchanger includes an inlet channel (7), which extends through substantially the whole plate package (2) and for each section (3, 4, 5) includes a separate inlet passage from the inlet channel (7) to the respective section, wherein each control member (12, 17, 18, 24, 32) is arranged to enable opening or closing of the respective inlet passage.

6. A plate heat exchanger according to claim 5, characterised in that the inlet channel (7) includes a pipe (30), which extends through the plate package (2) and has a longitudinal gap (31) forming said inlet passages.

7. A plate heat exchanger according to claim 6, characterised in that each valve includes a valve element (32), which extends along said pipe (30) and is rotatable between a first open position laterally of said gap (31) and a second closed position covering said gap (31).

8. A plate heat exchanger according to claim 7, characterised in that said pipe (30) has a radius (r), wherein the valve element (32) has a surface, which is arranged to abut the pipe (30) and which has a curvature that substantially corresponds to the radius of the pipe.

9. A plate heat exchanger according to claim 8, characterised in that each valve element (32) is connected to a respective shaft (33, 34, 35), which is rotatably provided in said pipe (30), wherein at least one (34, 35) of said shafts is tubular and arranged to house an other one (33, 34) of said shafts.

10. A plate heat exchanger according to claim 5, characterised in that the inlet channel (7) includes at

least two separate inlet conduits (21, 22, 23), which extend in parallel to each other but have a different length in such a manner that each inlet conduit extends to a respective section (3, 4, 5).

11. A plate heat exchanger according to claim 10, characterised in that said control members include a valve (24), which is provided on the respective inlet conduit (21, 22, 23).

12. A plate heat exchanger according to claim 5, characterised in that said control member is comprised by a valve plate (10, 11), which is provided between two adjacent sections (3, 4, 5).

13. A plate heat exchanger according to claim 12, characterised in that the inlet channel (7) includes a by-pass conduit (16), which extends from a section (3) through an adjacent section (4) to a successive section (5) of the plate package (2).

14. A plate heat exchanger according to claim 13, characterised in that said by-pass conduit (16) is provided in the inlet channel (7).

15. A plate heat exchanger according to any one of claims 13 and 14, characterised in that said control members includes a valve (17), which is provided immediately upstream of the by-pass conduit (16), wherein said valve includes a first valve member (17'), which is arranged to close or open the by-pass conduit (16), and a second valve member (17''), which is arranged to close or open the inlet passage to said adjacent section (4).

16. A plate heat exchanger according to any one of claims 12 to 15, characterised in that the plate heat exchanger

includes an outlet channel (8), which extends through substantially the whole plate package and which for each section (3, 4, 5) includes an outlet passage from the respective section to the outlet channel (8), wherein each control member includes a valve (12), which is arranged to enable opening or closing of the respective outlet passage.

Fig 1

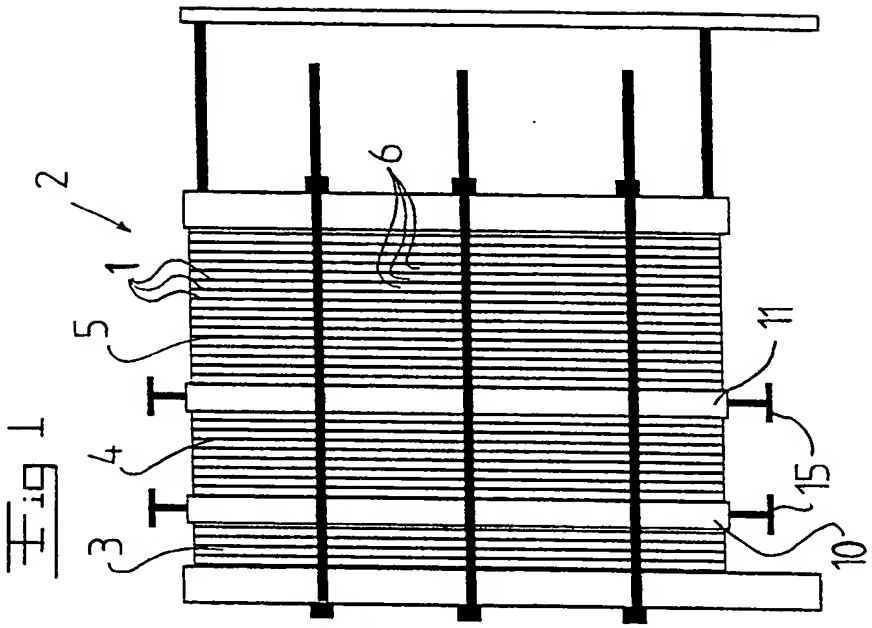


Fig 3

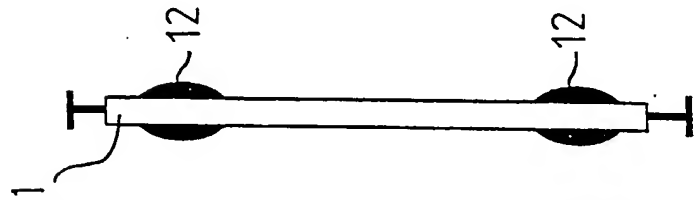
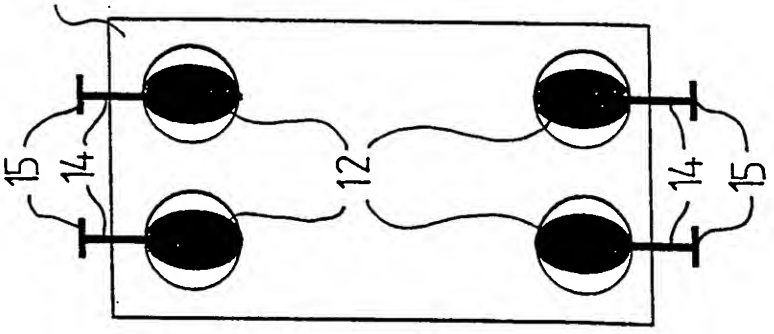


Fig 2



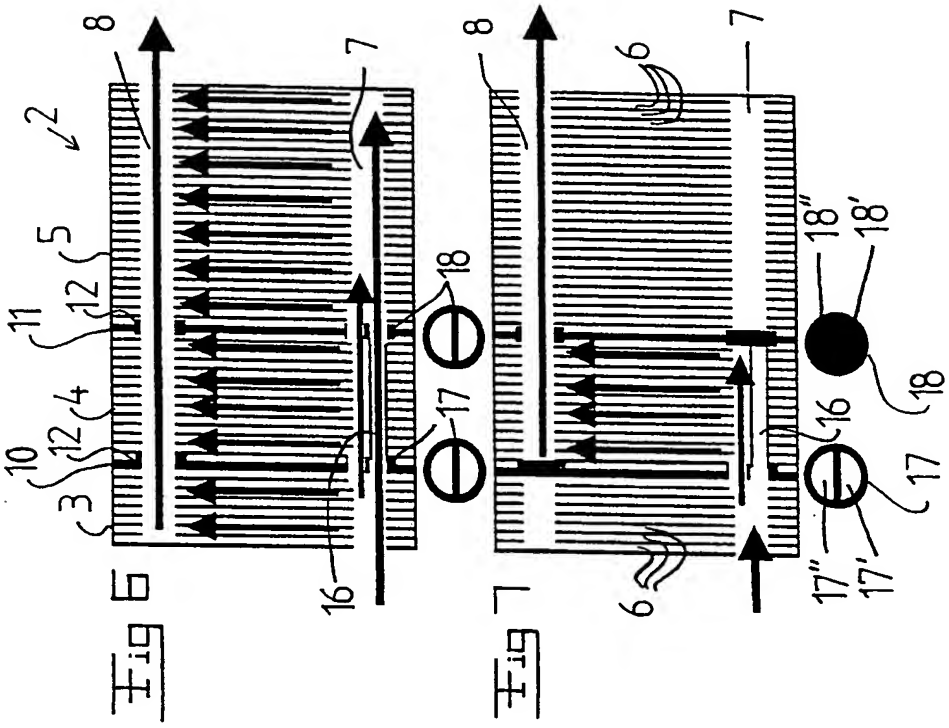


Fig 6
Fig 7

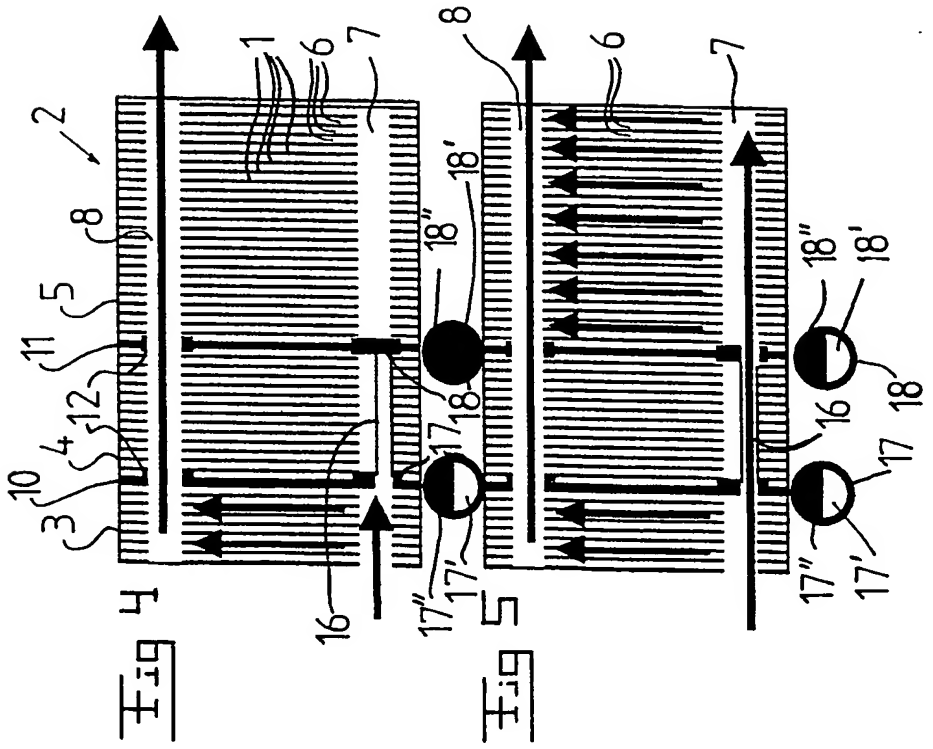


Fig 4
Fig 5

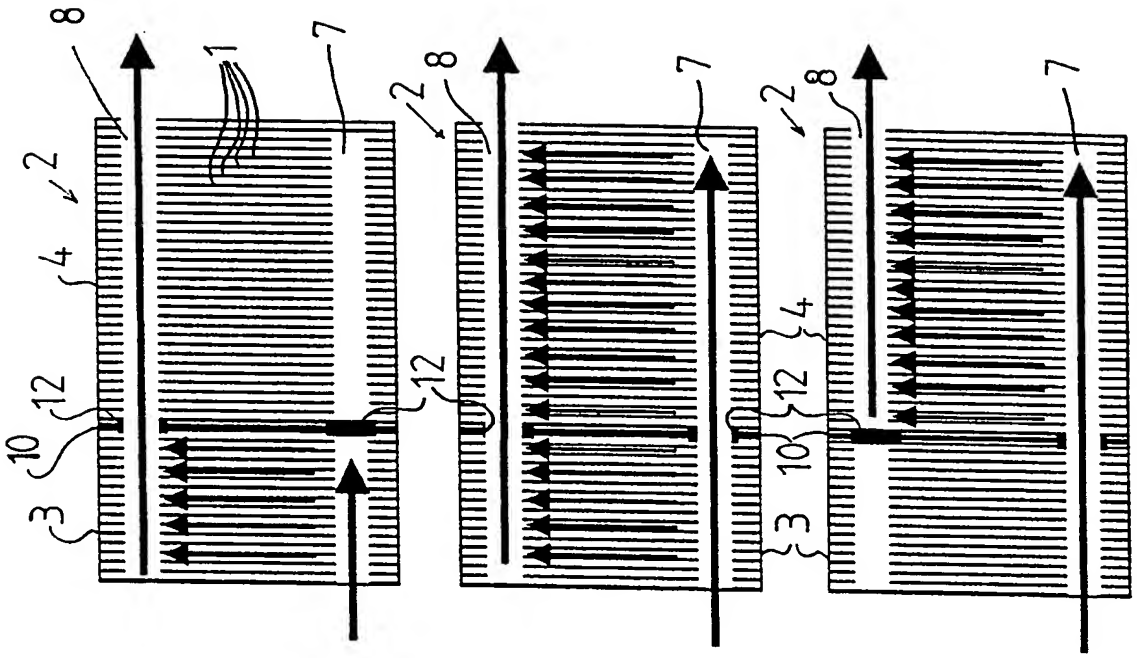


Fig 8 Fig 9 Fig 10

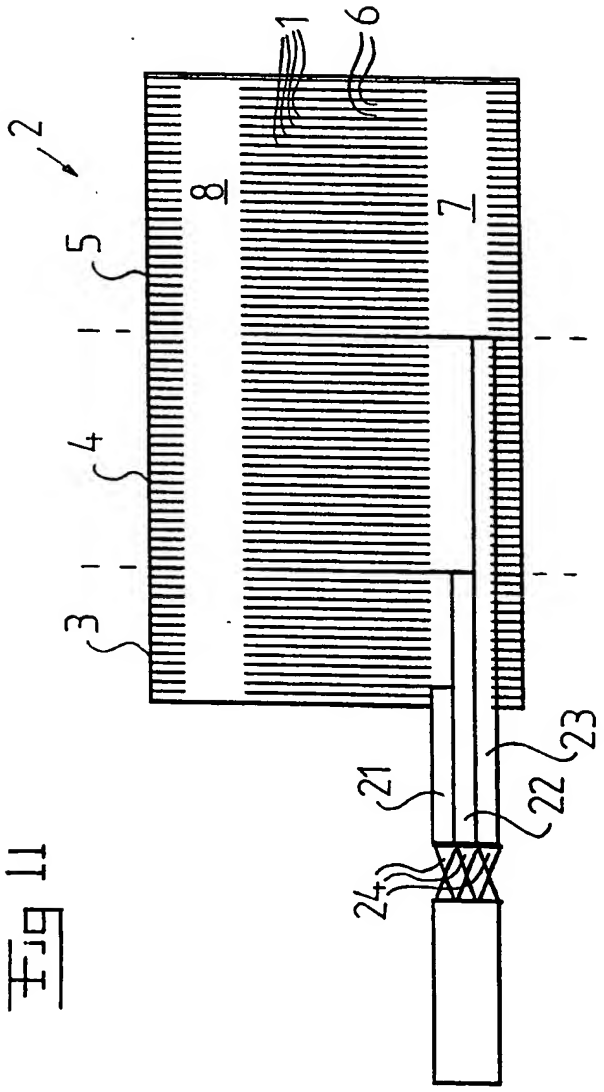


Fig 11

Fig 12

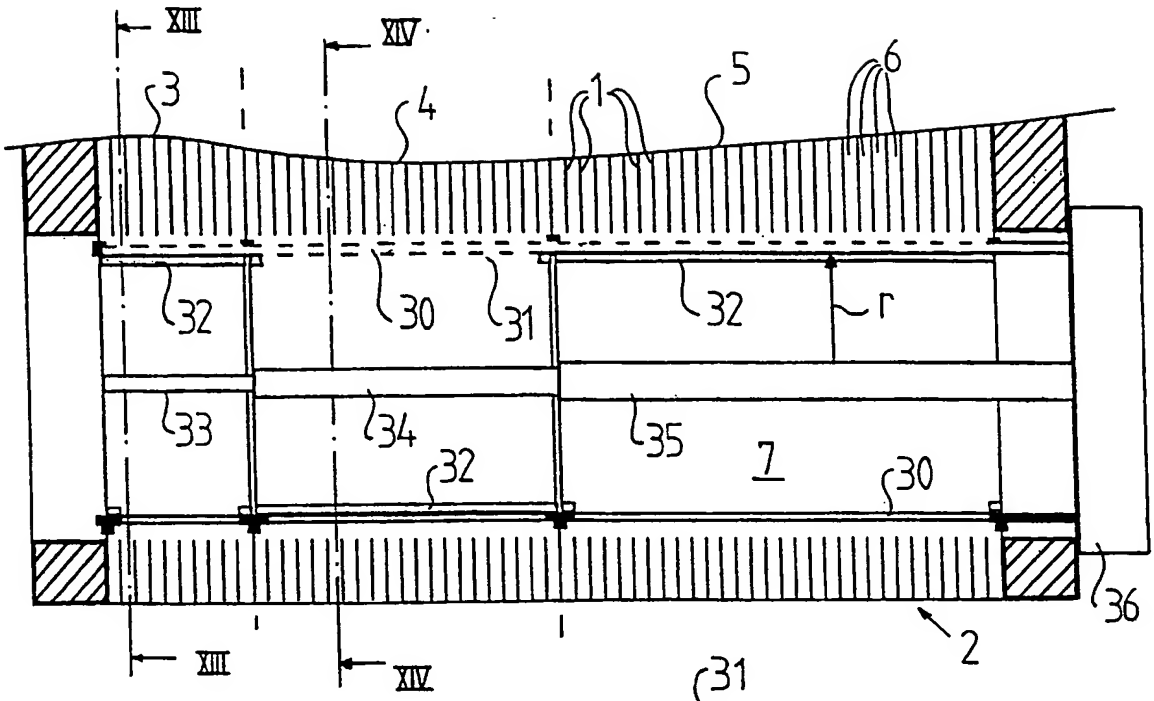


Fig 13

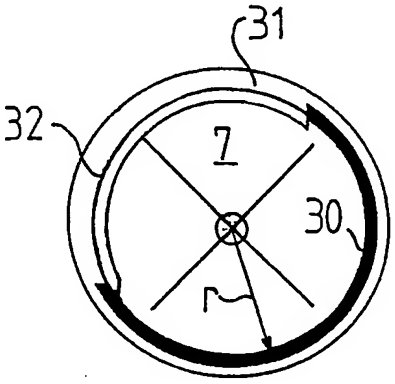
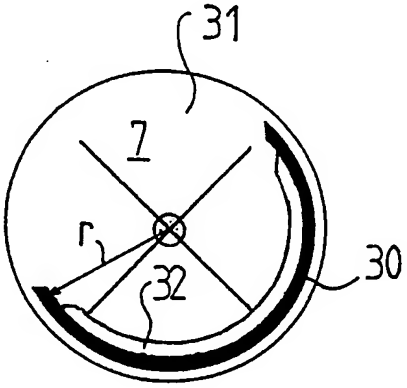


Fig 14



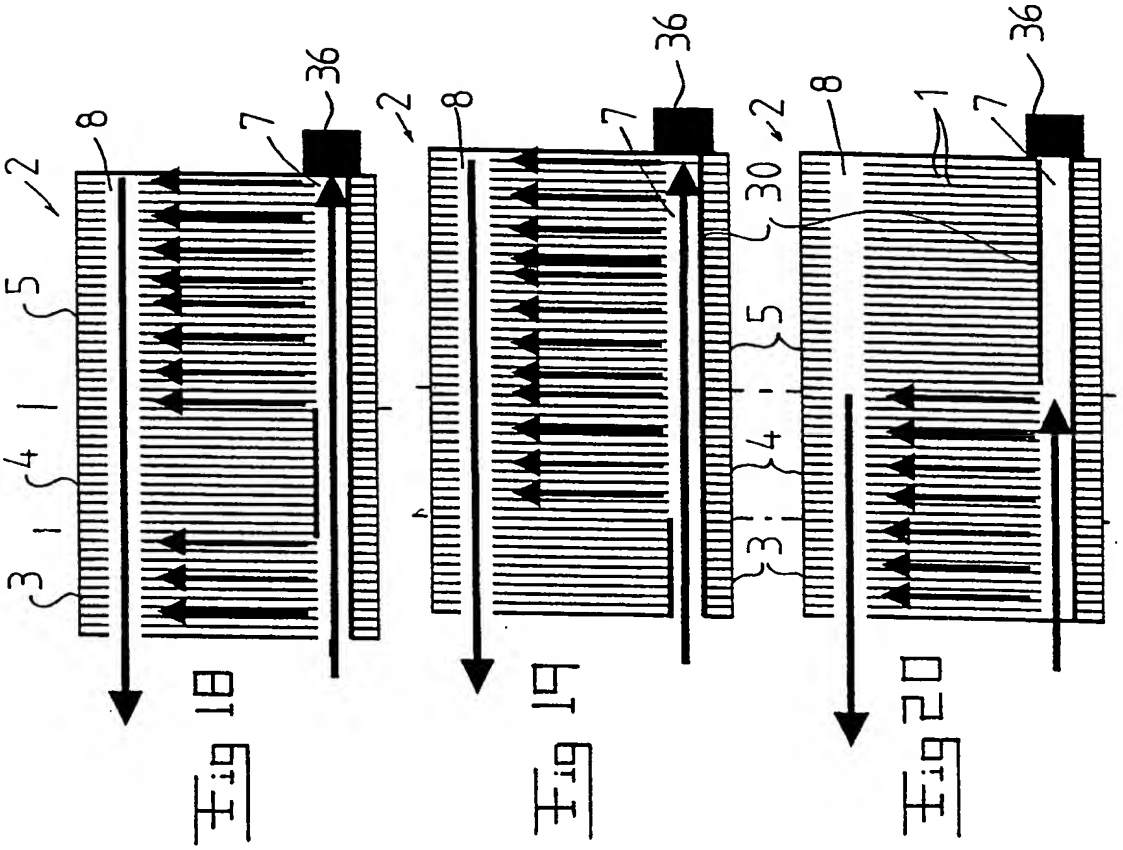


Fig 18 Fig 19 Fig 20

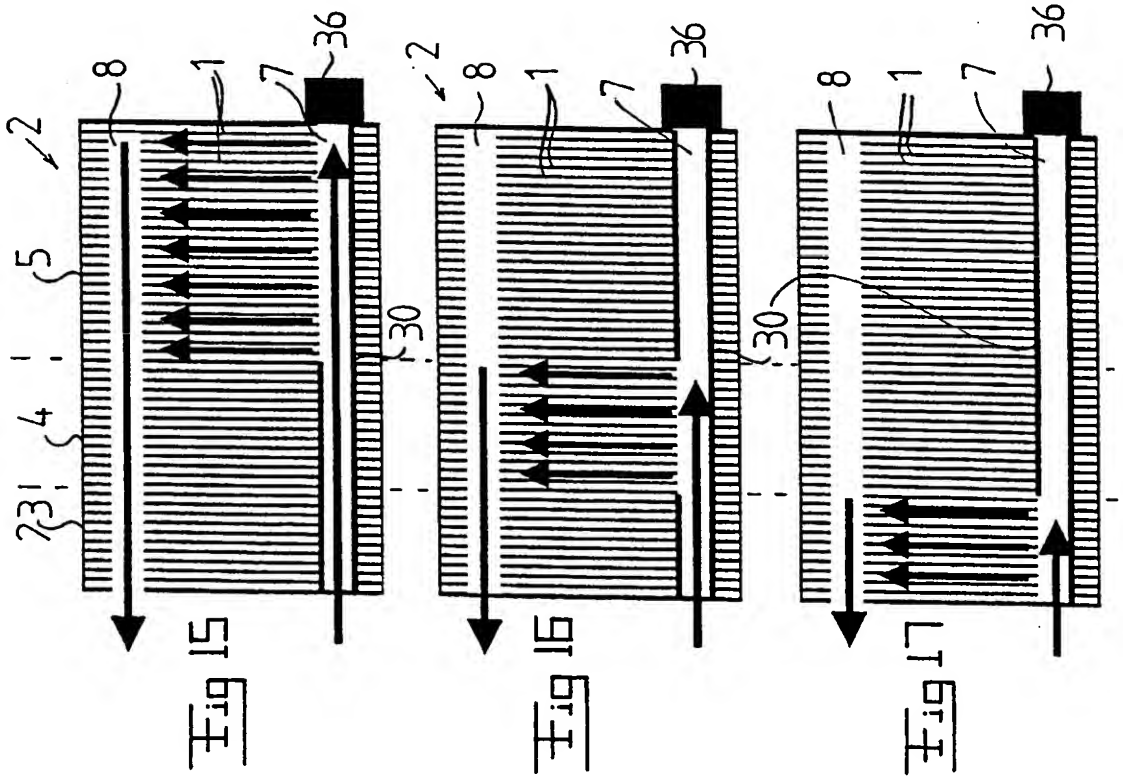


Fig 15 Fig 16 Fig 17

Fig 21

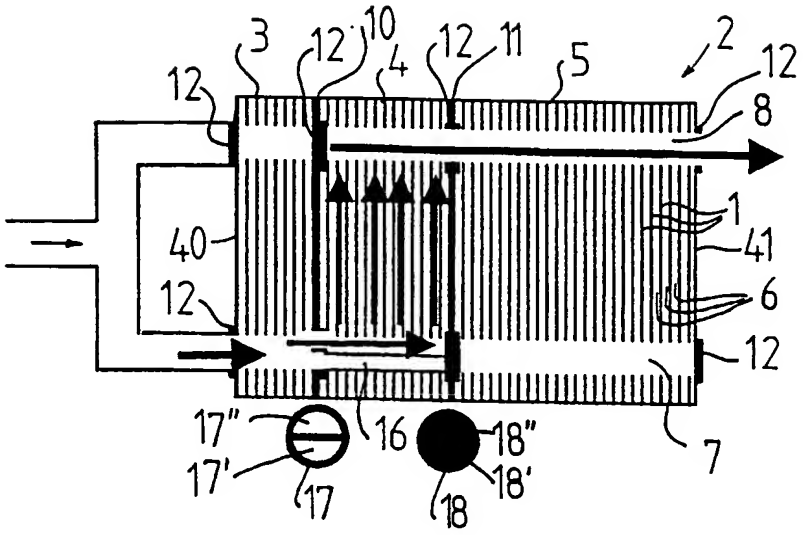

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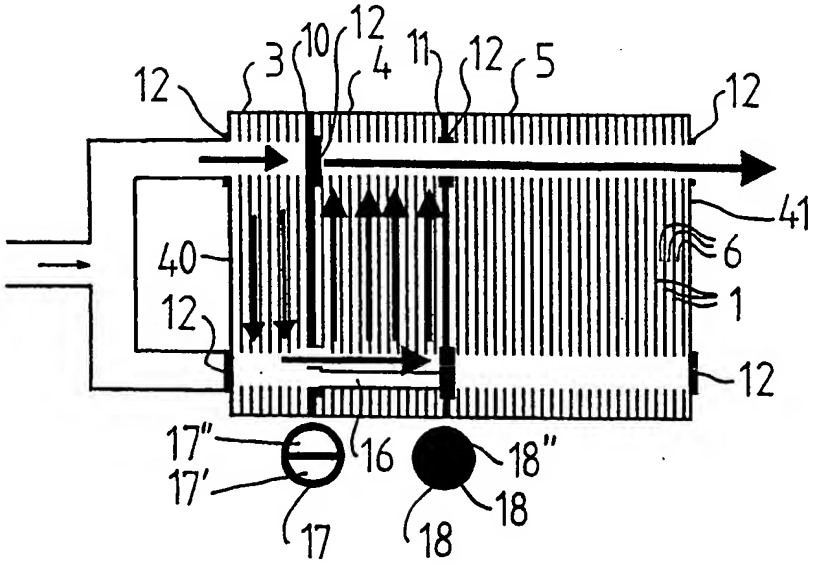
Fig 22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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/00978

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: F28F 27/02, F28D 9/00
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: F28F, F28D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 610228 C (BERGEDORFER EISENWERK AKT.-GES. ASTRA-WERKE), 6 March 1935 (06.03.35), page 2, line 18 - line 73, figure 1	
	--	
A	JP 4139390 (HISAKA WORKS LTD) 1992-09-02 (abstract) (online) (retrieved on 1999-12-21). Retrieved from: EPO PAJ Databse	
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A	DE 19525216 C1 (ROBERT BOSCH GMBH), 21 November 1996 (21.11.96), figures 1-4, abstract	
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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 August 2000	06 -09- 2000
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Dan Ionesco / JA A Telephone No. +46 8 782 25 00

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/00978

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2461225 A1 (THE A.P.V. COMPANY LIMITED), 30 January 1981 (30.01.81), figures 3-9, abstract --	
A	WO 9414021 A1 (MULTISTACK INTERNATIONAL LIMITED), 23 June 1994 (23.06.94), figures 2-8, abstract -- --------	

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Information on patent family members

02/12/99

International application No.
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